

**UNIFORM STANDARD
SPECIFICATIONS
for
PUBLIC WORKS
CONSTRUCTION**

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**1998
ARIZONA
(Includes revisions through 2005)**

FOREWORD

Publication of these Uniform Standard Specifications and Details for Public Works Construction fulfills the goal of a group of agencies who joined forces in 1966 to produce such a set of documents. Subsequently, in the interest of promoting county-wide acceptance and use of these standards and details, the Maricopa Association of Governments accepted their sponsorship and the responsibility of keeping them current and viable.

These specifications and details, representing the best professional thinking of representatives of several Public Works Departments, reviewed and refined by members of the construction industry, were written to fulfill the need for uniform rules governing public works construction performed for Maricopa County and the various cities and public agencies in the county. It further fulfills the need for adequate standards by the smaller communities and agencies who could not afford to promulgate such standards for themselves.

A uniform set of specifications and details, updated and embracing the most modern materials and construction techniques will redound to the benefit of the public and the private contracting industry. Uniform specifications and details will eliminate conflicts and confusion, lower construction costs, and encourage more competitive bidding by private contractors.

The Uniform Standard Specifications and Details for Public Works Construction will be revised periodically and reprinted to reflect advanced thinking and the changing technology of the construction industry. To this end a Specifications and Details Committee has been established as a permanent organization to continually study and recommend changes to the Specifications and Details. Interested parties may address suggested changes and questions to:

Standard Specifications & Details Committee
c/o Maricopa Association of Governments
302 North First Avenue, Suite 300
Phoenix, Arizona, 85003.

These suggestions will be reviewed by the committee and appropriate segments of the industry and cumulative annual revisions will be published the first of each year. A copy of this publication is available for review on the internet at the website listed below. Please follow the links to the publications page and look for *Uniform Standard Specifications for Public Works Construction* and/or *Uniform Standard Details for Public Works Construction*:

www.mag.maricopa.gov

While in the interest of uniformity, it is hoped that all using agencies will adopt these standards with as few changes as possible, it is recognized that because of charter requirements and for other reasons, some agencies will find it necessary to modify or supplement certain requirements.

SECTION 315

BITUMINOUS PRIME COAT

315.1 DESCRIPTION:

Bituminous prime coat shall consist of furnishing bituminous material and applying this bituminous material to a prepared base course, in accordance with these specifications.

315.2 MATERIALS:

Bituminous material shall conform to the requirements of Section 712 for the type and grade specified.

315.3 CONSTRUCTION METHODS:

315.3.1 Preparation of Surface: The surface on which the bituminous prime coat is to be placed shall be uniformly smooth and firm and reasonably true to grades and cross-sections as shown on the plans, and shall be so maintained throughout the period of placing the prime coat. In no event shall a prime coat be placed on a soft, uneven base. Any holes, depressions or irregularities shall be repaired by the removal of all loose and unsuitable material and replacement by suitable material, which shall be compacted to produce a dense surface conforming to the adjacent area. Uniformity of surface texture is of the utmost importance.

When required, the surface on which the prime coat is to be placed shall be lightly bladed and rolled immediately prior to the application of bituminous material.

315.3.2 Application of Bituminous Material: Bituminous material shall be applied only when the surface is either slightly damp or dry. For extremely dry areas, a light application of water may be required prior to the application of bituminous material.

The approximate quantity of bituminous material to be used will be specified; however, the exact amount used will be determined by the Engineer at the time of application. The bituminous material shall be uniformly applied to the prepared surface at the rate so designated and in one application.

The application of bituminous material and distributing equipment shall conform to the requirements of Section 330.

When it is deemed necessary, areas having excess bituminous material shall be blotted with material as directed.

When so directed, the surface of the complete prime coat shall be rolled with a pneumatic-tired roller.

315.3.3 Maintenance of Surface: Traffic shall be kept off the bituminous material until it has penetrated the base or subgrade and cured sufficiently.

The integrity of the prime coat shall be maintained at all times until the next course is placed or until the final acceptance. In the event traffic has caused holes or breaks in the surface, such holes or breaks shall be satisfactorily repaired by the Contractor.

315.4 MEASUREMENT:

The accepted quantities of bituminous material for bituminous prime coat will be measured by the ton undiluted for the bituminous material used.

No measurement or direct payment will be made for rolling.

Materials necessary for repair of holes or breaks in the surface after the prime coat has been accepted, when such holes or breaks are caused by traffic other than that of the Contractor, will be measured for payment under the respective contract item for the materials used.

315.5 PAYMENT:

Payment for the bituminous material will be on the basis of the price bid per ton, undiluted, complete in place.

Payment for furnishing, applying and removing blotter material will be paid for as an extra work item.

End of Section

SECTION 320

ROAD-MIXED SURFACING

320.1 DESCRIPTION:

Road-mixed surfacing shall consist of a mixture of mineral aggregate and bituminous binder mixed on the roadbed or other area, spread and compacted on a prepared subgrade or base course in conformity with the lines, grades, and dimensions shown on the plans or typical cross-section, or as specified in the special provisions.

320.2 MATERIALS:

Materials shall conform to the requirements of Sections 710 and 712 for the type and grade specified on the special provisions.

320.3 PRIME COAT:

When a prime coat is required, it shall be applied as specified in Section 315.

320.4 SPREADING AGGREGATE:

The mineral aggregate shall be deposited in a windrow along one side of the roadbed by means of approved spreader box equipped with a readily adjustable strike off device or other suitable equipment. The maximum lift for blade mixing and laying shall not exceed 1 cubic yard per running foot. If the mineral aggregate is delivered to the roadbed in separate sizes, each size of aggregate shall be spread in a windrow of the required quantity for that size of material, after which the windrows of various sizes shall be blended into one windrow alongside of the roadbed.

The aggregate shall be so spread that the windrows will be uniform and equal in size and will contain the proper quantity of material to provide surfacing of the required width and thickness. Care shall be exercised to prevent the aggregate from becoming mixed with earth or shoulder material. Preparatory to applying the liquid asphalt, a portion of the material from the windrow shall be spread uniformly over one-half the width of the roadbed.

Unless permitted by the Engineer, no more aggregate shall be spread on any one day than can be mixed with liquid asphalt within 72 hours. If traffic conditions require, the Engineer may require spread or flattened windrows.

320.5 APPLICATION OF LIQUID ASPHALT:

The temperature of the liquid asphalt, when applied, shall be in accordance with Section 712, and 16 to 22 gallons shall be applied for each cubic yard of road-mix material, in not less than 2 approximately equal applications.

Unless otherwise approved by the Engineer, no liquid asphalt shall be spread when weather conditions are unsuitable, or when the moisture content of the mineral aggregate exceeds 3 percent by weight of the dry aggregate. When the aggregate is unusually porous, the permissible moisture content may be increased and liquid asphalt spread at the discretion of the Engineer, when laboratory tests indicate that such increased moisture content will not produce an unstable mixture.

Liquid asphalt shall be prevented from spraying upon adjacent pavements, structure, guard rails, guide posts, culvert markers, trees and shrubbery, adjacent property and improvements, and other highway improvements or facilities not specifically mentioned herein, or that portion of the traveled way being used by traffic.

320.6 MIXING:

Immediately following each successive application of liquid asphalt, the surfacing material shall be thoroughly mixed by means of a blade. After the final application, the material shall be bladed into a windrow and the windrow bladed back and forth between the center and the edge of the area to be surfaced with a heavy blade grader having a wheel base not less than 16 feet long, until a satisfactory mixture of uniform appearance is obtained.

Should the mixture show an excess or deficiency of liquid asphalt, or uneven distribution thereof, prior to spreading and compacting, the condition shall be corrected by adding mineral aggregate or liquid asphalt, as the need may be, and remixing the material to produce a satisfactory mixture. If necessary, all compressed masses of material shall be broken up.

SECTION 321

Break down and compaction rolling shall be done by either steel-wheel or pneumatic-tire rollers. The Engineer may require a pneumatic-tire roller for one of the rolling operations. Rolling shall continue until the specific gravity of the compacted mixture is not less than 95 percent of the specific gravity of specimens composed of the same materials in similar proportions or composed of the same mixture compacted in the laboratory by the 75 blow method of AASHTO T-245 if the mix was designed by the Marshall method. If the mix was designed by The Asphalt Institute's SP-2 Gyratory method, rolling shall continue until the specific gravity of the compacted mixture is not less than 93 percent of the maximum theoretical specific gravity (ASTM D-2041) of specimens composed of the same materials in similar proportions or composed of the same mixture compacted in the laboratory.

Finish rolling shall be done by means of steel-wheeled roller or a vibratory steel-wheel roller operated in the static mode.

The completed surfacing shall be thoroughly compacted, smooth and true to grade and cross-section and free from ruts, humps, depressions or irregularities. An acceptable surface shall not vary more than 1/4 inch from the lower edge of a 25-foot straightedge when the straightedge is placed parallel to the centerline of the roadway. The straightedge shall be furnished by the contractor and shall be acceptable to the Engineer.

All streets shall be water tested for drainage in the presence of the Engineer or designated representative before final acceptance. Any areas not draining properly shall be corrected to the Engineer's satisfaction at the Contractor's expense. Water for this testing shall be provided and paid for by the Contractor.

When deviations in excess of the above tolerance are found, humps or depressions shall be corrected to meet the specified tolerance, or shall be cut out along neat straight lines and replaced with fresh hot mixture and thoroughly compacted to conform with and bond to the surrounding area. Materials and work necessary to correct such deviations shall be at no additional cost to the Contracting Agency.

321.5.5 Preservative Seal: An asphalt concrete preservative seal shall be used on all new asphalt concrete pavement and shall comply with Section 334. The Engineer will make a field determination and provide the actual application rate or delete the requirement. This seal is not required for pavement matching and surface replacement over pipe trenches, etc., unless specified in the special provisions.

321.6 CORRECTIVE REQUIREMENTS FOR DEFICIENCIES:

321.6.1 Thickness: The engineer or the permittee will test the density and thickness of the asphalt concrete after pavement construction is complete, using cores. The cores will be taken by the Engineer at random locations, at a minimum sampling rate of one core per 1,000 feet of lineal distance per paver pass width. For residential streets, a paver pass width will be considered to be a minimum of 12 feet. For residential streets, a minimum of one core will be taken between intersecting streets or portions thereof. When a deficiency of more than 1/4 inch is found, two additional cores will be taken not closer than 100 feet apart nor closer than 100 feet to the original core, and the average of these three cores will be used to determine the amount of the deficiency. Further cores may be taken by the Contractor if he so chooses, to determine the limits of the deficiency, and shall be at no additional cost to the Contracting Agency but shall not be used in determining the average thickness of the pavement. Thickness of the cores shall be determined by average caliper measurement. Where pavement thickness is deficient by 1/4 inch or less, it will be paid for at the contract price. The contractor shall repair all of the core holes using hot asphalt concrete from the project or a high quality asphalt based patching compound.

Where the pavement is deficient in thickness by more than 1/4 inch but not more than 1/2 inch, payment will be reduced per Table 321-1.

SECTION 321

TABLE 321-1	
PAVEMENT THICKNESS PAYMENT REDUCTION (AC) For Thickness Deficiency of More Than 1/4 inch and less than 1/2 inch	
Specified Mat Thickness	Reduction in Payment or Corrective Action
A: When the agency is the contracting party:	
Less than 1.5 inches	50%
1.50 inches to 1.99 inches	33%
2.00 inches to 2.49 inches	25%
2.50 inches to 2.99 inches	20%
3.00 inches and over	17%
B: When the agency is not the contracting party (work under permit, e.g. subdivision, utilities, etc.)	
For all thicknesses	Corrective action shall be the same as that for pavement thickness deficiencies exceeding 1/2 inch as described below.

When the deficiency of the pavement thickness exceeds 1/2 inch, the pavement shall be overlaid on the area affected, but in no case less than one City block or 660 feet, whichever is less in length, for the full width of pavement, with a new mat of material specified by the Engineer, equal in thickness to the deficiency but not less than 1/2 inch in any instance. This is to be done at no additional cost to the Contracting Agency. At locations where specific grades must be maintained, such as adjacent to curb and gutter or to accommodate drainage, the asphalt concrete surface may require milling prior to placement of the overlay.

When the pavement is deficient in thickness by more than 1/4 inch, all coring done to establish this premise shall be done by a laboratory that is independent of the contractor, and who is working under the direction of the Engineer. The cost of this work shall be born by the contractor by reduction of payments due under the contract.

321.6.2 Density: The Engineer or the permittee will test the density and thickness of the asphalt concrete after pavement construction is complete using cores. The cores will be taken in the same pattern as defined in Section 321.6.1, except that additional cores shall be taken if the density is less than the specified density. When the density represented by the average of three cores is deficient and the Contractor is unable to correct the deficiency, corrective action will be taken as prescribe in Table 321-2. For the purposes of this specification, the material represented by the set of three cores shall include all of the material placed in that paver pass for a length extending from half the distance to the previous core to half the distance to the next core.

At the discretion of the Engineer, for density deviations equal to or less than one percent, the average density of all of the cores taken from a given day's production may be used to represent all of the material placed that day.

The Agency's approval of the mix design does not guarantee the mix can be compacted to the specified limits. The Contractor shall work closely with the mix designer, compaction equipment manufacturers and the material supplier to assure the mix approved for use on the project can be compacted to the limits specified.

SECTION 321

TABLE 321-2	
PAVEMENT DENSITY CORRECTION (ASPHALT CONCRETE)	
Deviation Below Specification	Action
A. When the Agency is the Contracting Party:	
Equal to or less than 1.0%	\$1.00/ton of Asphalt Concrete penalty
Greater than 1.0% and equal to or less than 2.0%	\$2.00/ton of Asphalt Concrete penalty
Greater than 2.0% and equal to or less than 3.0%	\$3.00/ton of Asphalt Concrete penalty
Greater than 3.0%	See Note Below
B. When the Agency is not the contracting party (work under permit, e.g.: subdivisions, utilities etc.)	
Equal to or less than 2.0%	See Agencies' policies, amendments, etc. pertaining to the action
Greater than 2.0% and equal to or less than 3.0%	Mill and inlay at a minimum depth of three times the nominal aggregate size using the same mix as specified for the project
Greater than 3.0%	See Note Below

Note: The Contractor shall remove and replace the entire asphalt layer that is deficient. The dimensions of the repairs shall be the width of the paver or 12 feet, whichever is greater, and the length of one City block or 660 feet, whichever is less.

321.6.3 Mineral Aggregate: When the mineral aggregate gradation deviates from the requirements of this specification in an amount which, in the opinion of the Engineer, will affect the stability or durability of the mix, the Contractor shall, as directed by the Engineer, either: remove the asphalt concrete and replace it with material which meets the requirements of this specification, or place an additional mat of such thickness and gradation as required by the Engineer which will, in the opinion of the Engineer, correct the deficiency.

The above corrective work, due to deviations from the requirements for mineral aggregate, shall be done at no additional cost to the Contracting Agency.

321.6.4 Acceptance Testing Requirements: Tests used to determine acceptance under Section 321.6 will be performed by the Engineer or a laboratory employed by the Engineer. In either case, the laboratory shall be accredited by the AASHTO Materials Reference Laboratory (AMRL) or an equivalent certification Agency for AASHTO Method T 166.

If the Contractor has reason to question the validity of any of the acceptance test results, he may request that the Engineer consider verification tests for final acceptance. Any request for verification testing must describe the Contractor's reasons for questioning the validity of the original acceptance results and must clearly describe which set of acceptance tests are in question. The Engineer may either accept or reject the request for verification testing.

If the Engineer accepts the request for verification testing, he will engage an independent laboratory who is accredited by AMRL or equivalent. The independent laboratory shall be paid by the Engineer and shall perform a completely new set of acceptance tests (as required by 321.6) representing the area or set of tests in question. These tests shall include unit weight and thickness of cores, as well as Marshall or Maximum theoretical unit weight of the material obtained from the cores.

The verification tests shall be made on 6-inch diameter core specimens taken as near as it is practical to the acceptance test locations. For each sample, a minimum of three core specimens shall be taken, and the average values for unit weight and/or thickness shall be used.

SECTION 321

An adequate number of cores will be taken so their combined weight will be sufficient for a laboratory unit weight test in accordance with ASTM D2041 or AASHTO T 166, as appropriate for the specified mix design. The appropriate laboratory unit weight test shall be performed on the verification sample after re-heating and re-mixing the core specimens. The cores shall be prepared for testing by cleaning with a steel brush and by removing any extraneous lifts of differing materials. After removing extraneous materials, the entire core specimen will be used in the laboratory unit weight determination without removing aggregate particles that were cut by coring or trimming.

The number of samples taken will be in accordance with the Engineer's acceptance test frequency. The independent laboratory shall compile the test results and transmit them to both the Engineer and the Contractor. The independent laboratory shall include a letter signed by an Engineer registered in the State of Arizona, who is a specialist in asphalt concrete. The signed letter shall give an opinion that the material evaluated either does or does not comply with project specifications, and shall clearly describe any deficiencies.

If the difference in test results of the independent laboratory versus the original acceptance laboratory falls outside the multi-laboratory precision statements for the test methods being used, the contracting Agency will bear the cost of the verification testing. If the difference in tests results fall within the multi-laboratory precision statement, the cost for verification testing will be deducted from payments that were to be made to the Contractor. For test methods that do not have multi-laboratory precision statements, the cost for verification testing will be deducted from payments that were to be made to the contractor.

321.6.5 Asphalt Cement Content: Corrective requirements and penalties for deficient asphalt cement as determined by tests conducted on the asphalt material used for paving shall be as indicated in Section 710.4.2 Asphalt Cement Content and Table 710-10 Asphalt Cement Content Corrective Action for Deviations.

321.6.6 Air Voids: Corrective requirements and penalties for deficient air voids as determined by tests conducted on the asphalt material used for paving shall be as indicated in Section 710.4.4 Volumetrics and Table 710-11 Laboratory Voids Acceptance and Penalties.

321.7 CURBS:

The curb shall be placed by an approved extrusion type machine. In the event the Contractor wishes to utilize a template which varies from the cross-section shown on the plans, such change must meet the approval of the Engineer. The asphalt mix used shall be a 9.5 mm mix. One percent by weight of the total mixture shall consist of a granulated synthetic resin stiffener, Lexite or equal, complying with the following characteristics:

Softening Point (Ring & Ball)	ASTM D36	210°F. minimum
Acid Number	ASTM D465	Less than 1.00
Saponifiable matter	ASTM D464	Less than 1%
Iodine Number	ASTM D29	175—185

321.8 MEASUREMENT:

Asphalt concrete pavement will be measured by the ton, or by the square yard, for the mixture actually used as allowed above, which shall include the required quantities of mineral aggregates, filler material, asphalt cement, and sand. Measurement shall include any tonnage used to construct intersections, roadways, streets, or other miscellaneous surfaces indicated on the plans or as directed by the Engineer.

Weighmaster's Certificates, in accordance with Section 109, will be provided regardless of method of measurement.

The bid price per ton or square yard for asphalt concrete shall include the cost of the asphalt cement in the percentages as specified in Section 710.

Asphalt concrete curbs will be measured by the linear foot, parallel to the base or foundation, unless otherwise specified.

Preservative seal for asphalt concrete pavement will be measured by the gallon diluted, unless otherwise indicated in the special

SECTION 321

provisions.

321.9 PAYMENT:

The asphalt concrete measured as provided above, will be paid for at the contract price per ton or square yard, which price shall be full compensation for the item complete, as herein described and specified.

Payment for tack coat will be by the ton diluted, based on the rate of application; as directed by the Engineer.

The quantities of preservative seal, measured as provided above will be paid for at the contract bid price per gallon diluted or as specified, which price shall be full compensation for the item complete as herein described or as specified.

No payment will be made for any overrun in quantity of asphalt concrete in excess of 10 percent based on actual field measurement of area covered, design thickness, and a unit weight of 145 pounds per cubic foot. The calculations and payment for overrun will be by individual bid item. To compensate or adjust for a thickness deficiency in an underlying asphalt concrete course, the Engineer may authorize a quantity increase in excess of 10 percent for a subsequent asphalt concrete course. In such cases, the quantity in excess of 10 percent will be paid for at the lowest unit bid price.

Payment for the curbs will be at the contract unit price bid per linear foot, which price shall be full compensation for the curb complete in place, including all necessary labor, equipment and material.

Except as otherwise specified in the special provisions, no separate payment will be made for work necessary to construct miscellaneous items or surfaces of asphalt concrete.

End of Section





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SECTION 341

341.3.1 Installation: Place the terrazzo mix in the spaces formed by the divider strips in such a manner that the marble chips match the chosen pattern in the National Terrazzo and Mosaic Association, Inc. catalog. The mix shall be rolled into a compact mass by means of heavy stone or metal rollers until the superfluous cement and water is extracted, after which it must be hand troweled to an even surface, disclosing the lines of the divider strips on a level with the terrazzo finish.

The finished course shall show at least 75 percent of marble granules and shall not vary in any direction more than 1/8 inch when tested with a 10 foot straightedge. The thickness of the terrazzo course shall be 2 inches. The temperature of the mix at time of placing shall be between 60° and 80°F. and shall be maintained above 70°F. for at least 3 days or above 50°F. for at least 5 days when using normal portland cement.

341.3.2 Curing: The terrazzo course must be cured by keeping it moist for at least 6 days by wet sand, paper, or curing mats.

341.3.3 Surfacing: When the terrazzo work has set sufficiently hard, it shall be machine rubbed, using No. 24 grit or finer abrasive stones for the initial rubbing. It shall then be resurfaced using a No. 80 grit or finer abrasive stone, after which a light grouting of neat portland cement of the same kind and color as the matrix shall be applied to the surface, filling all voids. The grouting shall then remain until the time of final cleaning. All grinding shall be done in the presence of an excess of water.

341.3.4 Finishing: The grouting shall be removed by machines, using a stone not coarser than No. 80 grit. This cleaning for fine-stoning shall not take place sooner than 7 days after the surface has been grouted, after which it must be cleaned thoroughly.

341.3.5 Sealing: After cleaning and drying, seal the terrazzo surface with one coat of Hornlux or other sealer approved by the National Terrazzo and Mosaic Association, Inc.

341.4 MEASUREMENT:

Terrazzo sidewalk will be measured to the nearest square foot complete in place.

341.5 PAYMENT:

Payment will be made at the unit price bid per square foot, and shall be compensation in full for all construction equipment, labor, materials, plant, services, transportation, and all incidentals necessary to construct a sidewalk with a terrazzo surface course.

End of Section

SECTION 342

DECORATIVE PAVEMENT CONCRETE PAVING STONE OR BRICK

342.1 GENERAL:

The Contractor shall furnish all necessary labor, material, tools and equipment to complete the proper installation of decorative concrete pavers used in medians, crosswalks, intersections or as otherwise noted in the Contract Documents. This includes furnishing a 10-foot straightedge to accomplish the level test when required by this specification.

The decorative pavement shall be true in line and grade and installed to coincide and align with the adjacent work elevation. All edges shall be retained to secure the pavers and sand laying course.

The Contractor shall construct a sample panel 10-feet by 10-feet for inspection and approval by the Engineer, prior to the actual installation for the project. Once approved, the panel shall be used as a standard for the remainder of the work. The panel shall remain undisturbed through out the construction of the pavers and final approval by the Engineer.

342.2 MATERIALS:

342.2.1 Aggregate Base Course: Aggregate Base Course shall be per Table 702-1.

342.2.2 Portland Cement Concrete: When the pavers are subject to vehicular traffic, Portland Cement Concrete shall be Class A per Section 725. All other locations, the Portland Cement Concrete shall be a minimum of Class B per Section 725.

342.2.3 Sand: Sand used for laying course shall conform to ASTM C-33 except for the gradation. The gradation shall comply with Table 342-1.

TABLE 342-1								
SAND GRADATION								
Sieve Size	3/8 inch	No. 4	No. 8	No. 16	No.30	No. 50	No. 100	No. 200
Percent Passing	100	95-100	85-100	15-85	25-60	10-30	2-10	0-1

342.2.4 Concrete Pavers: Pavers shall have a minimum of thickness of 80 mm (3.15) when installed in traffic bearing areas and 60 mm (2.36 in.) When installed in non traffic bearings areas. Pavers shall be of an interlocking design conforming to ASTM C-936-82. Pavers shall be sound and free of defects that would interfere with the proper placing of the unit or impair the strength or permanence of the construction. The Contractor shall submit two samples of each type of pavers used on the project for review and approval by the Engineer prior to any work. The pavers and materials used in their manufacture shall conform to the following:

- (A) Compressive Strength: Pavers shall have a minimum compressive strength of 8,000 psi in accordance with ASTM C-140.
- (B) Absorption: The average absorption shall not be greater than 5 percent, with no individual unit absorption greater than 7 percent.
- (C) Portland Cement: Cement shall comply with Section 725.2, Type II.
- (D) Aggregates: Aggregates shall conform to ASTM C-33 (washed, graded sand and rock, no expanded shale or lightweight aggregates).
- (E) Other Constituents: Coloring pigments shall be applied integrally to the concrete. Air entraining admixtures, coloring pigments, integral water repellents, and finely ground silica shall be previously established as suitable for use in concrete and either shall conform to ASTM standards where applicable, or shall be shown by test or experience not to be detrimental to the concrete.
- (F) Physical Properties: The size, shape, design and color of the pavers shall be as noted in the Contract Documents.

342.2.5 Expansion Joint: Expansion joint filler material shall be 1/2-inch premolded and comply with Section 729 and ASTM D-1751.

SECTION 342

342.3 CONSTRUCTION PROCEDURES:

342.3.1 Subgrade: The subgrade shall be constructed true to grades and lines shown on the plans and compacted to a minimum dry density of 95% as specified in MAG Section 301.

342.3.2 Aggregate Base Course: When aggregate base course is specified, the aggregate base course shall be constructed true to grades and lines shown on the plans and compacted to a minimum dry density of 100% per Section 301 with the surface of the aggregate base course not varying by more than +1/8-inch in 10-feet.

342.3.3 Concrete Header and Base Slab: Forms shall be thoroughly cleaned each time they are used, and shall be coated with a light oil, or other releasing agent of a type which will not discolor the Portland Cement concrete.

The Portland Cement concrete shall be thoroughly spaded away from the forms so that there will be no rock pockets next to the forms. Compacted by mechanical vibrators may be used when approved by the Engineer. Tamping or vibrating shall continue until the mortar flushes to the surface, and the coarse aggregate has been tamped below the surface.

All edges shall be shaped with a suitable tool to form a rounded edge of radius as directed in Detail 225.

The Portland Cement concrete header face form shall not be removed before the concrete has taken the initial set and has sufficient strength to carry its own weight. The concrete header outer form shall not be removed until the concrete has hardened sufficiently to prevent any damage to the concrete. Any porting of concrete damaged while stripping forms shall be repaired or if the damage is severe, replaced at no additional cost to the Contracting Agency. The face and top of the concrete header shall be tested with a 10-foot straightedge or curve template, longitudinally along the surface. Any deviation in excess of 1/4-inch in 10-feet shall be corrected at no additional cost to the Contracting Agency.

Any section of the work deficient in depth or not conforming to the plans or specifications shall be removed and replaced by the Contractor at no additional cost to the Contracting Agency.

Finishing and curing of the concrete shall be done in the manner specified in Section 340.

342.3.4 Expansion Joints: Expansion joints shall be constructed to the full depth and width of the concrete with the top of the material one-half inch below the top surface as depicted in Detail 255 unless otherwise specified. After the concrete is cured, the top one-half inch shall be filled to the surface of the concrete with a premium-grade, high-performance, moisture-cured, single-component, polyurethane-based, non-sag elastomeric sealant, ASTM C-920, Type S, Grade NS, Class 25, Sikaflex-la or equal.

Joints shall be constructed in a straight line and vertical plane perpendicular to the longitudinal line of the concrete header, except in cases of curved alignment when they will be constructed along the radial lines of the header. In the case of base slabs, pavers shall be placed continuously over the expansion joints.

342.3.5 Contraction Joints: Contraction joints shall be constructed in a straight line and vertical plane perpendicular to the longitudinal line of the concrete header, except in cases of curved alignment when they will be constructed along the radial lines of the header. They shall be constructed to a depth of one inch with rounded edges and placed at 10-foot intervals. Contraction Joints shall be filled to the surface of the surrounding concrete with elastomeric sealant specified in 342.3.3.

342.3.6 Sand Laying Course: The maximum thickness of the sand course shall be one-inch. Screeding boards shall be used to ensure a uniform thickness. The sand shall not be compacted, walked on or wet down.

342.3.7 Concrete Paving Stones: The concrete pavers shall be clean and free of foreign materials before installation. Paving work shall be plumb, level and true to line and grade and shall be installed to properly coincide and align with adjacent work and elevations. All edges must be retained to secure the perimeter pavers and the sand laying course. The pavers shall be laid in such a manner that the desired pattern is maintained and joints between the pavers are as tight as possible.

The Contractor shall lay the pavers starting from the longest straight line and from a true 90-degree corner. The pavers shall be installed hand-tight and level on the undisturbed sand course in a manner that eliminates gaps between the stones and the edge retention header. String lines shall be used to hold all pattern lines true. The gaps at the edge of the paver surface shall be filled with pavers cut to fit. Cutting shall be accomplished to leave a clean edge to the traffic (vehicular or pedestrian) surface using a masonry saw cut.

After the pavers are in place, they shall be vibrated into the sand laying course using a vibrator capable of 3,000 to 5,000 pounds compaction force. This will require two passes at 90 degrees to each other. After vibration, approximately 1/4-inch of clean

SECTION 342

masonry sand containing at least 30 percent of 1/8-inch particles shall be placed over the paver surface, allowed to dry, and vibrated into the joints with additional vibrator passes and brushing so as to completely fill joints. Excess sand shall be swept from the surface.

The finished paver surface shall be tested longitudinally and transverse to the concrete header or curb with a 10-foot straightedge along the surface. Any deviation in excess of 1/8-inch shall be corrected at no additional cost to the Contracting Agency.

Any broken or damaged pavers shall be removed and replaced. Replacement pavers shall be tamped into place and the joints filled with masonry sand as specified herein. The completed installation shall be cleaned of all debris, surplus material and equipment.

342.4 MEASUREMENT AND PAYMENT:

Measurement will be the square foot. Payment will be made at the unit bid price per square foot. This payment shall be full compensation for all labor, materials, tools and equipment required to complete the work.

End of Section





SECTION 343

EXPOSED AGGREGATE PAVING

343.1 DESCRIPTION:

Exposed aggregate paving consists of placing a concrete slab with exposed aggregate in the surface of the finished concrete. This exposed aggregate paving is designed for decorative or pedestrian use only. It should not be used in areas subject to vehicular traffic.

343.2 MATERIAL:

343.2.1 Concrete: Concrete shall be Class A per Section 725 with a maximum slump of 3 inches.

343.2.2 Exposed Aggregate: The exposed aggregate shall be uncrushed river-run rocks. The Contractor shall provide at least a 10-pound sample for approval by the Engineer prior to any aggregate paving.

(A) When the paving is for decorative use only, no pedestrian traffic, the aggregate shall not be larger than 3 inches or smaller than 1 1/2 inches.

(B) When the paving is to be used for pedestrian traffic, the aggregate shall be not larger than 2 inches or smaller than 1 inch.

343.3 CONSTRUCTION PROCEDURE:

The Contractor shall construct a sample panel 3 feet by 3 feet for inspection and approval by the Engineer, prior to actual construction. When approved, this panel shall be used as a standard for the remainder of the work.

After the slab has been placed, screeded and darried, the aggregate shall be hand-scattered so that the entire surface is evenly covered. The surface shall be reworked so that the aggregate will be embedded just beneath the surface. The concrete shall completely surround and lightly cover the aggregate leaving no holes or voids.

A non-staining surface retarder will be applied to provide a surface penetration of at least 1/8-inch and the surface will be lightly screed to ensure penetration. The surface will be covered with a protective material for the period of time recommended by the retarder manufacturer. After this time has elapsed, the upper, retarded layer of concrete will be removed using a water jet stream and a brush. The protective cover will be replaced and the concrete allowed to cure. After curing, the surface shall be cleaned and a silicone seal applied.

343.4 MEASUREMENT AND PAYMENT:

Measurement will be by the square foot. Payment will be made at the unit bid price per square foot. This price shall be full compensation for all labor, material, tools, and equipment required to complete the work.

End of Section

SECTION 710

ASPHALT CONCRETE

710.1 GENERAL:

Asphalt concrete shall be a mixture of asphalt cement and mineral aggregates. Mineral admixture, mineral filler and anti-stripping agent shall be included in the mixture when required by the mix design or by the Engineer. All materials shall be proportioned by weight, volume or a combination in a central mix plant in the proportions required by the mix design to provide a homogeneous and workable mass.

The asphalt concrete mixes shall be of the types shown in Table 710-1.

TABLE 710-1			
ASPHALT CONCRETE MIXES			
Designation (mm)	Application	Design Target Lift Thickness For Mixes Above The Restricted Zone, inches	Design Target Lift Thickness for Mixes Below The Restricted Zone, inches
9.5	Surface Course	1.0 inches	1.5 inches
12.5	Surface Course	1.5 inches	2.0 inches
19.0	Base or Surface Course	2.5 inches	*3.0 inches
25.0	Base Course	3.0 inches	4.0 inches

*19mm mixes designed below the restricted zone are not for use as a surface course.

The designation is the nominal maximum aggregate size of the mix. The nominal maximum aggregate size is defined as the next largest sieve size above the first standard sieve to retain more than 10 percent of the mineral aggregate. The standard sieve sizes are 9.5 mm, 12.5 mm, 19 mm and 25 mm.

Each mix shall be designed for low, or high traffic conditions. Low traffic conditions are conditions where the asphalt mix will be subject to low volume and low weight vehicle usage. Examples of this condition are residential streets, most parking lots and residential minor collector streets. High traffic conditions are conditions where the asphalt mix will be subject to high volume and/or heavy weight vehicle usage as found on major collector, arterial and commercial streets. Street classifications (i.e. minor collector and major collector shall be determined by the specifying agency.

710.2 MATERIAL:

710.2.1 Asphalt Cement: The asphalt cement specified in this section has been developed for use in desert climate conditions. Should it be utilized in other climates, consideration should be given to adjustments in the asphalt selection. The asphalt cement shall be a performance grade asphalt conforming to the requirements of Section 711 for PG 70-10, unless otherwise specified in the plans or special provisions.

710.2.2 Aggregate: Coarse and fine aggregates shall conform to the applicable requirements of Section 701, except as modified herein.

Coarse aggregate is material retained above the 2.36 mm sieve and fine aggregate is material passing the 2.36 mm sieve.

Blend sand (naturally occurring or crushed fines) shall be clean, hard and sound material which will readily accept asphalt coating. The blend sand grading shall be such that, when it is mixed with the other mineral aggregates, the combined product shall meet the grading requirements of the designated mix, as specified in tables 710-2, 710-3 and 710-4.

The natural sand shall not exceed 15 percent by weight of the total aggregate for all mixes.

SECTION 710

710.2.2.1 Aggregate Structure: For mix design only, the combined aggregates, including the mineral admixture, mineral filler and anti-strip agent, shall meet the gradation requirement in Table 710-2.

TABLE 710-2					
GRADATION REQUIREMENTS-PERCENT BY WEIGHT PASSING					
Sieve Size (mm)	Designation (mm)				
	9.5	12.5	19	25	37.5
50.0	—	—	—	—	100
37.5	—	—	—	100	90-100
25.0	—	—	100	90-100	<90
19.0	—	100	90-100	<90	—
12.5	100	90-100	68-88	—	—
9.5	90-100	<90	56-80	—	—
4.75	<90	—	—	—	—
2.36	32-67	28-58	23-49	19-45	15-41
0.075	2.0-10.0	2.0-10.0	2.0-8.0	1.0-7.0	0-6.0

The limits of a restricted zone shall be defined as the sieve gradations in Table 710-3.

TABLE 710-3					
RESTRICTED ZONE BOUNDARY Percent Passing (Minimum-Maximum)					
Sieve Size (mm)	Designation (mm)				
	9.5	12.5	19	25	37.5
4.75	—	—	—	39.5-39.5	34.7-34.7
2.36	47.2-47.2	39.1-39.1	34.6-34.6	26.8-30.8	23.3-27.3
1.18	31.6-37.6	25.6-31.6	22.3-28.3	18.1-24.1	15.5-21.5
0.60	23.5-27.5	19.1-23.1	16.7-20.7	13.6-17.6	11.7-15.7
0.30	18.7-18.7	15.5-15.5	13.7-13.7	11.4-11.4	10.0-10.0

When plotted on a Federal Highway Administration 0.45 Power Gradation Chart, the aggregate grading shall miss the restricted zone as shown in Table 710-3. Any gradation that passes through the restricted zone will be considered unacceptable. When the asphalt pavement will be subject to high traffic conditions, the gradation curve shall fall below the restricted zone.

When the asphalt pavement will be subject to low traffic conditions, the gradation curve may fall on either side of the restricted zone.

710.2.2.2 Aggregate Characteristics: The coarse and fine aggregates shall comply with the requirements of Table 710-4.

710.2.3 Mineral Filler, Mineral Admixture and Anti-Stripping Agent: Mineral filler shall conform to the requirements of AASHTO M-17. The amount of mineral filler shall be determined by the mix design.

SECTION 750

IRON WATER PIPE AND FITTINGS

750.1 CAST IRON WATER PIPE:

All cast iron water pipe shall be designed in accordance with AWWA C-101.

Cast iron water pipe may be designed for either 18/40 or 21/45 physicals and shall conform to AWWA C-106 or AWWA C-108.

Except as otherwise provided cast iron or water pipe shall be designed to meet internal pressure of 150 psi, external cover of 5 feet, and standard Laying Condition B.

Cast iron pipe shall be nominal 18 foot lengths.

Pipe shall be cement mortar lined and seal coated in accordance with AWWA C-104.

750.2 DUCTILE IRON WATER PIPE:

All ductile iron water pipe shall be designed in accordance with AWWA C-150 and shall be manufactured in accordance with AWWA C-151. The class shall be as designated in the plans or special provisions.

Pipe shall be cement mortar lined and seal coated in accordance with AWWA C-104.

750.3 JOINT REQUIREMENTS:

Push-on joints for cast iron or ductile iron water pipe shall conform to AWWA C-111 and shall include synthetic rubber gaskets and lubricant.

Mechanical joints for cast iron or ductile iron water pipe shall conform to AWWA C-111 and shall include cast iron glands, synthetic rubber gaskets, and T-head bolts and nuts.

Flanged joints for cast iron or ductile iron water pipe shall be as detailed on the plans or as designated in the special provisions.

Restrained Joints:

When noted on plans or approved by the Engineer, joints for push-on or mechanical jointed ductile pipe may be modified to provide a fully restrained joint. These modifications to push-on and mechanical joints, including but not limited to segmented or special glands and split sleeves, shall conform to AWWA C-111. The Engineer shall review and/or approve each manufacturer's modifications to the joint. Upon request of the Engineer, the manufacturer of the modified joint shall provide test data showing compliance with AWWA C-111.

750.4 FITTINGS:

Iron fittings shall be either Gray-Iron or Ductile Iron conforming to AWWA C-110 or AWWA C-153 with a minimum pressure rating of 250 psi. Flanged ends shall conform to AWWA C-110. Push-on and mechanical joints ends shall conform to AWWA C-111.

Fittings shall be cement mortar lined and coal-tar coated in accordance with AWWA C-104.

End of Section

SECTION 752

ASBESTOS-CEMENT WATER PIPE AND FITTINGS

752.1 GENERAL:

These specifications cover asbestos-cement pressure pipe intended for use in supply lines and distribution systems that carry water under pressure.

752.2 CLASSES:

Asbestos-cement pipe shall be manufactured and tested in accordance with AWWA C-400, except as modified herein, for pipe intended for use in water service at maximum operating pressures of 100, 150, or 200 psi. Pipe shall be designated as Classes 100, 150, or 200 respectively, for the corresponding maximum operating pressures. Unless shown otherwise on the plans or specified in the special provisions the minimum acceptable shall be Class 150.

752.3 MANUFACTURE:

The joining ends of the pipe shall be of such design that they may be properly connected to cast iron fittings and valves which are manufactured within the continental United States that meet applicable AWWA specifications. Pipe in sizes less than 6 inches in diameter may be supplied in either 10 foot or 13 foot lengths, and pipe in sizes 6 inches or greater in diameter shall be supplied in 13 foot lengths, except for random and special short lengths in all sizes as permitted in AWWA C-400.

752.4 INSPECTING AND TESTING:

The uncombined calcium hydroxide in the pipe and couplings shall not exceed 1 percent when tested in accordance with AWWA C-400. Certification of all manufacturer's tests in accordance with AWWA C-400 shall be required. In addition, the Contracting Agency may require all inspection and testing to be performed at the manufacturer's plant or at an approved testing laboratory.

All pipe manufactured outside the United States of America will be subject to inspection and testing by the Contracting Agency at the plant site or at an approved testing laboratory. In addition, all pipe shall have the Underwriters Laboratory, Inc. seal of approval and certification that all tests were in accordance with AWWA C-400.

752.5 FITTINGS:

Fittings shall be cast iron or ductile iron and conform to AWWA C-110 or C-153 for 250 psi minimum working pressure rating cast on fittings. All fittings shall have Ring-Tite, Fluid-Tite, or Weld-Tite bells to fit the class of pipe specified. All fittings shall be cement lined in accordance with AWWA C-104.

752.6 RUBBER RINGS:

Each coupling shall have 2 synthetic rubber joint sealing rings conforming to the requirements of ASTM D-1869. This paragraph shall also apply to the rings furnished for use with fittings. Neoprene shall not be used.

End of Section

SECTION 758

CONCRETE PRESSURE PIPE - STEEL CYLINDER TYPE

758.1 GENERAL:

These specifications apply to Concrete Pressure Pipe intended for use in water supply pipelines that carry water under pressure. Concrete pressure pipe is specified as follows:

(A) Reinforced concrete pressure pipe-steel cylinder type, pretensioned, shall be designed, manufactured and tested in accordance with AWWA C-303. With agreement by the purchaser and the manufacturer, pipe may be manufactured to larger sizes and for higher pressures than indicated herein.

Reinforced concrete pressure pipe may be furnished in pipe diameters of eighteen (18) inches through seventy-two (72) inches.

Pipe shall be designed by the methods described in Appendix A, AWWA C-303 to resist the internal pressures and external loading conditions designated on the approved plans or in the project specifications.

(B) Prestressed concrete pressure pipe steel cylinder type, shall be designed, manufactured and tested in accordance with AWWA C-301 and AWWA C-304.

Prestressed concrete pressure pipe may be furnished in pipe diameters forty-two (42) inches and larger.

Pipe shall be designed by the methods described in AWWA C-304 to resist the internal pressures and external loading conditions designated on the approved plans or in the project specifications.

758.2 MANUFACTURE:

The Contractor shall submit design calculations, a tabulated layout schedule, and details of specials and fittings to the Engineer for review and approval.

When specified in the project specifications, the manufacturer shall furnish all samples, test reports, test specimens and perform tests as provided in AWWA C-303 or AWWA C-301.

An approved rust inhibitor shall be applied on the exposed portions of the steel joint rings.

The Contractor shall submit an affidavit of compliance from the manufacturer that the pipe and fittings furnished comply with all applicable provisions of AWWA C-301 or AWWA C-303.

The Engineer or his representative shall be allowed access to the manufacturer's plant for the purpose of inspecting the pipe and fittings.

End of Section

SECTION 759

STEEL PIPE

759.1 GENERAL:

These specifications apply to Steel pipe intended for use in water supply pipelines that carry water under pressure. Steel pipe is specified as follows:

Steel pipe shall be designed, manufactured and tested in accordance with AWWA C-200.

Steel pipe and fittings may be furnished in pipe diameters of six (6) inches and larger.

Pipe shall be designed by the methods described in AWWA C-200 and AWWA Manual M11, to resist the internal pressures and external loading conditions designated on the approved plans or in the project specifications.

Trench excavation, backfilling and compaction shall be in accordance with Section 601 unless otherwise specified in the plans and specifications. For Steel Pipe with a flexible coating the backfill pipe zone material shall consist of Granular Material, maximum 3/4 inch size.

As an option, the backfill in the pipe zone may be Controlled low strength material (CLSM) in accordance with Section 728 and placement per Section 604.

759.2 LINING AND COATING OPTIONS:

(A) Cement mortar lining and cement mortar coating shall be in accordance with AWWA C-205.

(B) Polyurethane coatings for interior and exterior of steel pipe shall be in accordance with AWWA C-222. The MDFT shall be 20 mils. on the interior lining and 25 mils. on the exterior coating.

(C) Polyethylene tape coating shall be in accordance with AWWA C-214. The total thickness of the tape coating shall be minimum 50 mils for pipe up to 54 inches diameter and minimum 80 mils for pipe 54 inches diameter and larger.

(D) Liquid-Epoxy coating systems for the interior and exterior of steel water pipelines shall be in accordance with AWWA C-210. Interior lining will be applied in one or two coats MDFT of 16 mils.

All linings for potable waterlines shall be NSF approved.

759.3 MANUFACTURE:

The contractor shall submit design calculations, a tabulated layout schedule, and details of specials and fittings to the Engineer for review and approval.

When specified in the project specifications, the manufacturer shall furnish all samples, test reports, test specimens and perform tests as provided in AWWA C-200 or AWWA manual M11.

Standard pipe shall be furnished with rolled-groove bell and spigot rubber gasket joints. Restrained joints shall be lap-welded slip joints with the bell formed by cold formed expanded dies.

Unless otherwise specified, fabricated steel pipe shall be manufactured in uniform lengths to fit the pipeline alignment shown on the plans, subject to a maximum length of 40 feet. For Steel Pipe with flexible coatings the pipe length may be 60 foot maximum, subject to the Manufacturer's recommendations. Shorter lengths may be furnished to facilitate special conditions.

SECTION 770

770.4 BOLTS:

Unfinished Bolts: The bolts shall have square heads and square nuts unless otherwise specified. The bolts shall be long enough to extend entirely through the nut but not more than 1/4 inch beyond. Washers shall not be furnished unless specified.

Steel bolts shall conform to the requirements of ASTM A-307, except that steel manufactured by the acid Bessemer process shall not be used.

High Strength Bolts: High strength bolts shall conform to the provisions of the specification for the design, fabrication and erection of structural steel for buildings of the AISC.

770.5 ANCHOR BOLTS:

Anchor bolts shall be manufactured from steel conforming to ASTM A-36 or A-307.

770.6 MILD-STEEL FORGINGS FOR STRUCTURAL PURPOSES:

Steel forgings shall be made from steel of forging quality and shall conform to the requirements of ASTM A-668. They shall be Class C forgings with a maximum carbon content of 0.35 percent and shall be given a thorough annealing. The metal shall have a minimum Brinnel hardness number of 130, and a maximum of 190, when tested in accordance with ASTM E-10.

End of Section



SECTION 771

GALVANIZING

771.1 GENERAL:

Materials shall be hot-dip galvanized and the weight and uniformity of coating determined in accordance with the standard specifications given in Table 771-1.

TABLE 771-1		
GALVANIZING SPECIFICATIONS		
Material	ASTM Spec.	Wt. of Coating Oz./Sq. Ft. (Min.)
Corrugated Metal Pipe	A-929	1.80
Flat Steel or Iron Sheets	A-653, A-924	1.25
Iron or Steel Wire	A-116	.80
Chain Link Fabric	A-392	1.20
Barbed Wire	A-121	.50
Steel Pipe - Rails and Posts	A-53	1.80
Structural Shapes, Tie Rods, Ornamental Iron Railings, Handrails, Manhole and Catch Basin Steps, and Curb Armor	A-123	2.00
Bolts, Nuts, Washers, Anchor Bolts, Packing Spools, Gray Iron and Malleable Iron Castings and Steel Castings	A-153	1.25

771.2 WORKMANSHIP:

The galvanizing shall be applied in such a manner that the spelter will not peel off. The finished product shall be free from blisters and excess spelter, and the coating shall be even, smooth, and uniform throughout. Machine work, die work, cutting, punching, bending, welding, drilling, thread cutting and other fabricating shall all be done as far as is practicable before the galvanizing. No member shall be galvanized which is out of alignment. All members (nuts, bolts, washers, etc.) shall be galvanized before a structural unit is assembled. All uncoated spots or damaged coatings due to poor workmanship, rough handling, or any other reason shall be cause for rejection.

771.3 TEST COUPONS:

Test coupons for determining the quality of the galvanizing shall be wired to the materials to be galvanized before immersion in such a manner as to represent the amount of coating deposited on the materials.

771.4 REPAIR OF GALVANIZED SURFACES:

Unless otherwise specified, where galvanized surfaces are field or shop cut, broken, burned or abraded, thus breaking the galvanizing, the locations thus damaged shall be repaired to the satisfaction of the Engineer with zinc dust-zinc oxide coating conforming to AASHTO M-36.

End of Section